

Exploring Quintuple Helix Collaboration for Sustainable Community Development through Social Enterprises in Malaysia

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ABSTRACT

This study explores the role of Quintuple Helix collaboration in supporting social enterprises in Malaysia. The Quintuple Helix model emphasizes collaboration among universities, industry, government, public society, and the natural environment in achieving sustainable community development. Social enterprises in Malaysia face various challenges, including financial sustainability, limited networking opportunities, and lack of institutional support. Therefore, collaboration among multiple stakeholders is essential to strengthen their sustainability and social impact. This study employed a qualitative approach using semi-structured interviews with 11 social enterprises operating in Malaysia. The collected data were analyzed using thematic analysis. The findings revealed that universities contribute through training, internships, and knowledge sharing, while industries provide mentorship, networking, and funding opportunities. Government agencies support social enterprises through financial assistance, policy initiatives, and entrepreneurship programs. Public society contributes through volunteering and community engagement, whereas environmental organizations encourage sustainable practices and green initiatives. The study contributes to the growing literature on social entrepreneurship and collaborative ecosystems by providing empirical evidence on the importance of Quintuple Helix collaboration in supporting social enterprises in Malaysia.

Keywords: Quintuple Helix; Social Enterprise; Thematic Approach; Sustainable Community

INTRODUCTION

Social enterprises have emerged as significant drivers of social, economic, and environmental development across both developed and developing economies. Unlike conventional profit-oriented businesses, social enterprises pursue dual objectives of achieving financial sustainability while creating measurable social value. They address a wide range of societal challenges, including poverty alleviation, unemployment, educational inequality, healthcare accessibility, social inclusion, and environmental degradation (Mair & Marti, 2006; Bacq et al., 2022). In Malaysia, social enterprises have gained increasing recognition from policymakers, practitioners, and researchers due to their potential to contribute to sustainable community development and support the achievement of the Sustainable Development Goals (SDGs). Through innovative and community-oriented approaches, social enterprises complement government efforts by addressing social needs that are often underserved by traditional public and private sector interventions.

Despite their growing importance, social enterprises continue to face substantial challenges that threaten their long-term sustainability and social impact. Common barriers include limited access to financial resources, insufficient networking opportunities, weak institutional support, shortages of skilled human capital, and

difficulties in balancing social missions with commercial objectives (Doherty et al., 2014; Saebi et al., 2019). These constraints often limit organizational growth, innovation capability, and the ability to scale social impact. Consequently, scholars have increasingly emphasized the importance of collaborative ecosystems in supporting social enterprises, arguing that sustainable social value creation requires active engagement among multiple stakeholders who can contribute complementary resources, knowledge, and capabilities (Phillips et al., 2015; Bacq et al., 2022).

The Quintuple Helix model offers a comprehensive theoretical framework for understanding such multi-stakeholder collaboration. Building upon the Triple Helix and Quadruple Helix models, the Quintuple Helix framework incorporates five interconnected subsystems: universities, industry, government, public society, and the natural environment (Carayannis et al., 2012; Carayannis et al., 2018). The model emphasizes that innovation and sustainable development emerge from dynamic interactions among these helices through knowledge exchange, resource mobilization, collaborative governance, and societal engagement. A distinguishing feature of the Quintuple Helix is its explicit integration of environmental sustainability into innovation processes, thereby aligning economic development with social well-being and ecological preservation. As such, the framework is particularly relevant for examining how social enterprises navigate complex sustainability challenges while creating social and environmental value.

Although the Quintuple Helix model has attracted growing scholarly attention in studies of innovation ecosystems, sustainability transitions, and regional development, its application within social enterprise ecosystems remains underexplored (Galvao et al., 2021; Carayannis et al., 2022). Existing research has largely focused on innovation-driven sectors, higher education institutions, and public-private partnerships, with limited attention given to how the five helices collectively support the development and sustainability of social enterprises. Moreover, prior studies tend to examine stakeholder contributions in isolation, overlooking the interconnected and mutually reinforcing relationships among helices that may shape organizational outcomes. This limitation is particularly evident in developing economies, where institutional environments, resource constraints, and community needs differ substantially from those in developed countries.

In the Malaysian context, empirical evidence examining Quintuple Helix collaboration within social entrepreneurship remains scarce. While previous studies have highlighted the contributions of social enterprises to community development and social innovation, limited research has investigated how universities, industries, government agencies, civil society, and environmental actors interact to support these organizations. Consequently, there is insufficient understanding of the collaborative mechanisms that enable social enterprises to enhance their sustainability, innovation capacity, and community impact. Addressing this gap is important given Malaysia's increasing emphasis on social entrepreneurship as a catalyst for inclusive and sustainable development.

Therefore, this study aims to explore how Quintuple Helix collaboration supports social enterprises in Malaysia and contributes to sustainable community development. By examining the experiences and perspectives of social enterprise leaders, this study seeks to provide empirical insights into the roles and interactions of the five helices within the Malaysian social enterprise ecosystem. The study contributes to the literature by extending the application of the Quintuple Helix framework to the context of social entrepreneurship and by proposing a deeper understanding of how multi-stakeholder collaboration facilitates sustainable community development in emerging economies.

LITERATURE REVIEW

Social Enterprise in Malaysia

Social enterprises have emerged as important organizations that address social and environmental challenges while maintaining financial sustainability. Unlike traditional profit-oriented businesses, social enterprises prioritize social missions alongside commercial activities. According to Mair and Marti (2006) social enterprises function as agents of social change by introducing innovative solutions to societal problems. Similarly, Nicholls (2010), explained that social enterprises combine entrepreneurial approaches with social value creation to improve community well-being.

In Malaysia, the development of social enterprises has gained increasing attention over the past decade. The Malaysian Global Innovation and Creativity Centre (MaGIC) defined social enterprises as organizations that proactively create positive social or environmental impact in a financially sustainable manner. Social enterprises in Malaysia operate in various sectors such as education, healthcare, poverty alleviation, environmental sustainability, and youth empowerment.

Previous studies highlighted the growing contribution of social enterprises toward sustainable community development in Malaysia. Adnan et al. (2018), argued that social enterprises play a significant role in empowering marginalized communities through employment creation, entrepreneurial training, and social inclusion initiatives. Furthermore, Ketprapakorn and Kantabutra (2019), stated that social enterprises contribute positively to economic and social sustainability by balancing profit generation with community welfare.

Despite their contributions, Malaysian social enterprises continue to face numerous challenges. Among the major challenges are lack of financial support, limited access to business networks, shortage of skilled human capital, and inadequate institutional support (Malaysia Social Enterprise Blueprint, 2015). These limitations often affect organizational growth and sustainability. Therefore, collaboration with external stakeholders becomes essential for strengthening the ecosystem supporting social enterprises.

Researchers have increasingly emphasized the importance of collaborative ecosystems in supporting social entrepreneurship. According to Doherty et al. (2014) social enterprises operate as hybrid organizations that require support from multiple sectors to sustain their social and commercial objectives. Similarly, Phillips et al. (2015), highlighted that collaboration among stakeholders contributes significantly toward innovation and long-term sustainability within social enterprises.

The increasing importance of social enterprises in addressing complex societal challenges indicates the need for stronger collaboration among universities, industries, governments, communities, and environmental organizations. This collaborative approach aligns with the Quintuple Helix model, which emphasizes multi-stakeholder cooperation in achieving sustainable development.

Quintuple Helix Collaboration

The Quintuple Helix model is a contemporary framework that explains how collaboration among multiple stakeholders contributes toward innovation, sustainability, and societal development. The model was introduced by Carayannis et al. (2012) as an extension of the Triple Helix and Quadruple Helix models. While the Triple Helix focuses on interactions among universities, industries, and governments, the Quintuple Helix incorporates two additional dimensions: public society and the natural environment.

According to (Carayannis et al., 2012), the Quintuple Helix model emphasizes the importance of knowledge exchange and innovation among five interconnected subsystems: education system, economic system, political system, civil society, and the natural environment. The integration of environmental sustainability distinguishes the Quintuple Helix from previous innovation models, making it highly relevant in addressing global sustainability challenges.

The Quintuple Helix model has increasingly been applied in studies related to sustainable development, innovation ecosystems, entrepreneurship, and community development. Halibas et al. (2017), explained that the Quintuple Helix framework encourages collaborative governance and collective problem-solving among different societal actors. Through this collaborative approach, organizations can generate innovative solutions that address economic, social, and environmental challenges simultaneously.

In the context of social enterprises, the Quintuple Helix model provides a useful framework for understanding how collaboration supports organizational sustainability and social impact. Social enterprises often rely on partnerships with universities, industries, government agencies, communities, and environmental organizations to obtain knowledge, funding, networking opportunities, and public support. According to Littlewood and Holt (2018), collaborative ecosystems are essential for strengthening social entrepreneurship because they provide access to resources and innovation capabilities that individual organizations may lack. Similarly, Carayannis et

al. (2012), emphasized that innovation and sustainable development can be achieved more effectively through interaction among multiple societal actors.

Universities contribute through research, training, and human capital development. Industries provide mentorship, investment opportunities, and market access that improve organizational sustainability and innovation capability (Etzkowitz & Zhou, 2023). Governments support social enterprises through policies, grants, and entrepreneurship programs that strengthen institutional legitimacy and operational sustainability (Nicholls, 2010). Communities contribute through participation, volunteering, and social engagement, while environmental organizations encourage sustainable practices and environmental awareness (Matarrita-Cascante & Brennan, 2012; Mensah, 2019)..

Previous studies also highlighted the role of Quintuple Helix collaboration in promoting sustainable community development. Le Blanc (2015), argued that collaborative relationships among multiple stakeholders are crucial for achieving Sustainable Development Goals (SDGs). Similarly, Halibas et al. (2017), stated that the Quintuple Helix framework supports innovation and community empowerment by encouraging cooperation between public and private sectors. Tonkovic et al. (2015), further explained that the Quintuple Helix model strengthens organizational innovation through knowledge exchange and collaborative governance.

University Support

Universities play a significant role in strengthening social enterprises through education, research collaboration, innovation support, and entrepreneurial development. Within the Quintuple Helix framework, universities function as knowledge producers that contribute toward innovation and sustainable community development (Carayannis et al., 2012). Academic institutions provide social enterprises with access to training programs, research expertise, student internships, and capacity-building initiatives that enhance organizational sustainability.

Previous studies highlighted that universities contribute significantly to entrepreneurial ecosystems by promoting innovation and knowledge transfer. According to Etzkowitz and Zhou (2023), universities are increasingly becoming entrepreneurial institutions that actively collaborate with industries and communities to address societal challenges. In the context of social entrepreneurship, universities help social enterprises improve managerial competencies, innovation capability, and strategic planning through entrepreneurship education and research collaboration.

In Malaysia, collaboration between universities and social enterprises has become increasingly important due to the growing emphasis on sustainable development and community engagement. Universities frequently organize entrepreneurship workshops, mentoring sessions, and innovation programs aimed at supporting social entrepreneurs (Apostu et al., 2022; Sidek et al., 2018). Internship programs also provide opportunities for students to contribute knowledge and skills while simultaneously exposing them to social innovation activities (Guerrero et al., 2016).

Moreover, university collaborations encourage knowledge sharing and research commercialization that benefit social enterprises. According to Guerrero et al. (2016), entrepreneurial universities contribute toward regional development by facilitating innovation networks and collaborative partnerships. Such collaborations allow social enterprises to gain access to technological expertise, innovative solutions, and professional networks that strengthen their long-term sustainability ((Etzkowitz & Zhou, 2023).

Industry Support

Industry collaboration plays a crucial role in strengthening the sustainability and operational capacity of social enterprises. Within the Quintuple Helix framework, industries contribute through financial support, mentorship, networking opportunities, technological expertise, and market access. Collaboration between industries and social enterprises enables the sharing of resources, innovation capabilities, and business knowledge that improve organizational sustainability and competitiveness.

Previous studies emphasized the importance of industry participation in fostering entrepreneurial ecosystems and innovation networks. According to Etzkowitz (2017), industries function as essential actors within collaborative innovation systems because they provide practical expertise, commercial opportunities, and market-oriented knowledge. In the context of social entrepreneurship, industry collaboration allows social enterprises to access strategic partnerships, investment opportunities, and capacity-building programs that strengthen organizational performance.

Partnerships between industries and social enterprises also contribute toward social innovation and sustainable development. Phillips et al. (2015), argued that collaborative relationships between private organizations and social enterprises facilitate innovative solutions for addressing societal challenges. Such collaborations often involve mentorship programs, sponsorships, joint projects, and technical assistance aimed at improving operational efficiency and social impact.

In Malaysia, industrial collaboration has become increasingly important for supporting social enterprises due to the competitive and resource-constrained nature of the sector. Many social enterprises rely on partnerships with corporations and private organizations for funding support, training opportunities, and market access (Phillips et al., 2015; Rahdari et al., 2016). Corporate social responsibility (CSR) initiatives also provide opportunities for industries to collaborate with social enterprises in addressing social and environmental issues (Kramer & Porter, 2011).

Moreover, industry partnerships contribute significantly to knowledge transfer and organizational learning. According to Urbano et al. (2017), collaborative business ecosystems encourage innovation, adaptability, and sustainability among entrepreneurial organizations. Through networking and mentorship, social enterprises can improve strategic management, financial planning, and innovation capability (Etzkowitz, 2017).

Government Support

Government support is widely recognized as one of the most influential factors contributing to the sustainability and growth of social enterprises. Within the Quintuple Helix framework, governments function as policy makers, regulators, and facilitators that create supportive ecosystems for innovation and sustainable development. Government agencies contribute through policy implementation, financial assistance, entrepreneurship programs, and institutional support that enable social enterprises to operate effectively.

Previous studies highlighted the importance of government intervention in supporting entrepreneurial ecosystems and social innovation. According to Carayannis and Campbell (2014), governments play a central role in facilitating collaboration among stakeholders by developing policies and institutional frameworks that encourage innovation and sustainability. In the context of social entrepreneurship, government support is essential because social enterprises often face financial constraints and operational challenges that require external assistance.

In Malaysia, the government has increasingly acknowledged the importance of social enterprises in promoting inclusive and sustainable development. The Malaysian Social Enterprise Blueprint and Social Enterprise Accreditation (SE.A) initiatives were introduced to strengthen the social enterprise ecosystem by providing financial support, training, and networking opportunities (MaGIC, 2015; MEDAC, 2021). Government agencies such as the Malaysian Global Innovation and Creativity Centre (MaGIC) and the Ministry of Entrepreneur Development and Cooperatives (MEDAC) actively organize entrepreneurship programs, workshops, and capacity-building initiatives to support social entrepreneurs (Adnan et al., 2018).

Financial assistance is among the most important forms of government support for social enterprises. According to Rahdari et al. (2016), access to funding and grants significantly influences the sustainability of social enterprises because many organizations struggle to balance social objectives with financial stability. Government grants, subsidies, and startup funding programs help social enterprises expand operations and increase their social impact. Similarly, Defourny and Nyssens (2010), emphasized that institutional financial support plays a critical role in enabling social enterprises to sustain long-term social missions.

Furthermore, government collaboration contributes toward policy legitimacy and institutional recognition for social enterprises. Nicholls (2010), argued that institutional support enhances the credibility and visibility of social enterprises, enabling them to attract partnerships and public trust. In Malaysia, policy initiatives such as the Social Enterprise Blueprint 2030 demonstrate the government's commitment to developing a supportive environment for social entrepreneurship (Malaysia Social Enterprise Blueprint, 2015).

Despite these initiatives, social enterprises in Malaysia continue to face challenges related to bureaucratic procedures, limited funding access, and regulatory uncertainties. According to Sarif, Sarwar, and Ismail (2013), insufficient policy coordination and limited institutional support remain major barriers affecting the development of Malaysian social enterprises. Therefore, stronger government collaboration and policy support remain essential for strengthening the sustainability of social enterprises.

Public Society Support

Public society represents an important component within the Quintuple Helix framework because community participation and public engagement significantly influence the success and sustainability of social enterprises. Public society includes local communities, non-governmental organizations (NGOs), volunteers, consumers, and civil society groups that contribute toward social innovation and sustainable development.

According to Carayannis et al. (2012), civil society functions as a knowledge and communication subsystem that facilitates collaboration, public awareness, and social participation. Public involvement enhances the effectiveness of social enterprises because communities directly contribute ideas, feedback, volunteering support, and social engagement activities.

Previous studies highlighted the importance of community participation in achieving sustainable community development. Matarrita-Cascante and Brennan (2012), argued that community involvement strengthens local empowerment, collective action, and social sustainability. In the context of social entrepreneurship, public support contributes toward organizational legitimacy, community trust, and stakeholder engagement.

Social enterprises frequently rely on volunteers and community members to support social initiatives and outreach programs. Volunteerism contributes significantly toward operational sustainability, particularly for organizations with limited financial resources. According to Doherty et al. (2014), collaborative relationships with communities allow social enterprises to improve social impact and strengthen stakeholder relationships. Similarly, Matarrita-Cascante and Brennan (2012), emphasized that community participation enhances local empowerment, social cohesion, and collective problem-solving within sustainable community development initiatives.

In Malaysia, public society support has become increasingly important due to growing awareness of social and environmental issues. Community engagement activities such as volunteering programs, public campaigns, fundraising events, and social awareness initiatives help social enterprises expand their reach and strengthen social impact (Adnan et al., 2018). Public feedback also contributes toward organizational improvement by helping social enterprises better understand community needs and expectations. According to Saebi et al. (2019), active stakeholder engagement improves social enterprise adaptability, legitimacy, and long-term sustainability.

Moreover, civil society organizations and local communities play a critical role in promoting social innovation and inclusive development. Carayannis et al. (2012), argued that public society acts as an important subsystem within the Quintuple Helix model by facilitating communication, participation, and knowledge exchange among stakeholders. Community collaboration also enables social enterprises to build trust and strengthen relationships with beneficiaries and stakeholders.

Environmental Support

Environmental sustainability represents the fifth dimension within the Quintuple Helix framework and distinguishes it from earlier innovation models. The inclusion of the natural environment emphasizes the importance of ecological sustainability in innovation, entrepreneurship, and societal development. Environmental organizations and sustainability initiatives encourage social enterprises to adopt environmentally

responsible practices that contribute toward long-term sustainable development (Carayannis et al., 2012). According to Carayannis et al. (2012), sustainable innovation can only be achieved through collaborative interaction among governments, industries, universities, public society, and environmental systems.

According to Carayannis et al. (2012), the natural environment acts both as a resource provider and a driver of innovation. Environmental challenges such as climate change, pollution, and resource depletion require collaborative solutions involving governments, industries, universities, and civil society. Social enterprises increasingly contribute toward environmental sustainability through green initiatives, recycling programs, sustainable production methods, and environmental awareness campaigns (Rahdari et al., 2016). Such initiatives not only address ecological concerns but also strengthen social awareness and community resilience.

Previous studies highlighted the growing relationship between social entrepreneurship and environmental sustainability. Rahdari et al. (2016), explained that social enterprises often integrate environmental objectives into their business models to create long-term societal value. Similarly, Mensah (2019), emphasized that environmental sustainability is closely linked to social and economic sustainability because environmental degradation directly affects community well-being and future development. Elkington (1997), further introduced the Triple Bottom Line concept, emphasizing the importance of balancing economic, social, and environmental objectives for sustainable organizational development.

In Malaysia, environmental sustainability has become an increasingly important issue due to concerns regarding climate change, waste management, and biodiversity conservation. Many Malaysian social enterprises actively engage in environmental initiatives such as sustainable agriculture, eco-tourism, recycling projects, and environmental education programs (Amran et al., 2012). These initiatives contribute toward community awareness and sustainable community development while simultaneously encouraging environmentally responsible behavior among local communities.

Furthermore, environmental collaboration strengthens organizational reputation and stakeholder trust. According to Mensah and Casadevall (2019), organizations that integrate environmental sustainability into their operations are more likely to achieve long-term sustainability and stakeholder support. Therefore, environmentally responsible practices contribute not only toward ecological preservation but also toward organizational sustainability and social impact.

METHOD

Research Design

This study employed a qualitative research approach to explore the role of Quintuple Helix collaboration in supporting social enterprises in Malaysia. A qualitative method was considered appropriate because the study aimed to gain an in-depth understanding of participants' experiences, perceptions, and collaborative practices within the social enterprise ecosystem. According to Creswell and Creswell (2017), qualitative research is suitable for exploring complex social phenomena and understanding meanings constructed by participants. Similarly, Fusch et al. (2018), stated that qualitative research enables researchers to examine social interactions and lived experiences within natural settings.

The study was underpinned by an interpretivist research philosophy, which emphasizes understanding social reality through participants' subjective experiences and interpretations. This philosophical position aligns with the study's objective of exploring how social enterprise leaders perceive and experience collaboration with universities, industries, government agencies, civil society, and environmental actors. An inductive approach was employed to allow themes and theoretical insights to emerge from participants' narratives rather than testing predetermined hypotheses (Saunders et al., 2019).

An inductive approach was utilized because the study sought to generate themes and insights from participants' responses rather than testing predetermined hypotheses. According to Thomas (2006), inductive analysis allows researchers to identify patterns and themes emerging directly from qualitative data. The research employed a cross-sectional design, whereby data were collected within a specific time period through semi-structured

interviews. Semi-structured interviews provide flexibility for participants to express their experiences while allowing researchers to maintain focus on the research objectives (Kallio, Pietilä, Johnson, & Kangasniemi, 2016).

Research Participants

Purposive sampling was employed to recruit participants who possessed substantial knowledge and experience regarding social enterprise operations and stakeholder collaboration. Purposive sampling is widely recommended in qualitative research because it facilitates the selection of information-rich participants capable of providing meaningful insights into the phenomenon under investigation (Patton, 2015).

The study involved eleven social enterprises operating in Malaysia (refer Table 1) across diverse sectors, including education, healthcare, environmental sustainability, youth empowerment, and poverty alleviation. Participants occupied leadership positions such as founders, chief executive officers (CEOs), managers, and co-founders, ensuring they possessed direct experience in organizational decision-making and collaborative activities.

To be included in the study, participants were required to satisfy three criteria:

1. The organization must operate as a social enterprise in Malaysia.
2. The participant must occupy a managerial or leadership position.
3. The organization must have experience collaborating with at least one Quintuple Helix stakeholder, including universities, industries, government agencies, public society, or environmental organizations.

Data collection continued until thematic saturation was achieved. Saturation refers to the point at which no substantially new themes, categories, or conceptual insights emerge from additional data collection (Hennink & Kaiser, 2022). During the analysis process, recurring patterns began to stabilize after the ninth interview, while interviews ten and eleven largely confirmed previously identified themes without generating new conceptual insights. Therefore, the sample size of eleven participants was considered sufficient to achieve thematic saturation and provide comprehensive coverage of the research phenomenon (Guest et al., 2020)

Table 1: Participant profile.

Respondent	Gender	Age	Education	Job Position	Year Founded	Num. of Employee	Form of Incorporation
Company 1	Female	31-40	Bachelor degree	Founder	2022	7	Social Enterprise
Company 2	Female	41-50	Degree	Manager	2016	10	Sdn Bhd
Company 3	Female	31-40	Degree	CEO/ President/ Vice President	2020	Less than 50	Profit
Company 4	Female	21-30	Bachelor degree	Co-Founder	2022	3	Non-Profit
Company 5	Female	31-40	Bachelor Degree	CEO	2018	6	Profit Corporation
Company 6	Female	41-50	Bachelor Degree	CEO	2015	50	Profit
Company 7	Male	41-50	Bachelor Degree	CEO	2007	9	Sdn Bhd
Company 8	Male	31-40	Master Degree	CEO	2020	45	Profit Corporation
Company 9	Male	31-40	Bachelor Degree	CEO	2016	50	Profit Corporation
Company 10	Female	41-50	Master Degree	CEO	2016	10	Profit
Company 11	Male	51-60	Master Degree	CEO	2016	22	Profit Corporation

Data Collection

Data for this study were collected through semi-structured interviews conducted with representatives of social enterprises in Malaysia. Semi-structured interviews were selected as the primary data collection method because they provide flexibility for participants to express their experiences, opinions, and perspectives while allowing the researcher to maintain focus on the research objectives (Kallio, Pietilä, Johnson, & Kangasniemi, 2016).

According to Saunders et al. (2019), semi-structured interviews are particularly suitable for exploratory qualitative studies because they enable researchers to obtain rich and detailed information regarding participants lived experiences and organizational practices.

The interview protocol was developed based on an extensive review of literature related to social enterprises, sustainable community development, and Quintuple Helix collaboration. The interview questions focused on exploring participants' experiences and perceptions regarding collaboration with universities, industries, government agencies, public society, and environmental organizations. Specifically, the interviews explored issues related to university collaboration, industry partnerships, government support, community engagement, environmental initiatives, and organizational sustainability. Examples of interview questions included: "How does your organization collaborate with universities or educational institutions?", "What forms of government support has your organization received?", "How does public society contribute to your organization's activities?", and "What environmental initiatives are implemented within your organization?". Open-ended questions were used to encourage participants to provide detailed explanations and reflections regarding their collaborative experiences.

Due to practical considerations and accessibility, the interviews were conducted online through Google Meet. Each interview lasted approximately 30 to 45 minutes. With participants' consent, all interviews were audio-recorded to ensure accurate transcription and facilitate systematic data analysis. According to Creswell and Creswell (2017), audio recording interviews enhances data accuracy and allows researchers to revisit participants' responses during the analysis process.

Prior to the interviews, participants were informed about the objectives of the study, confidentiality procedures, and voluntary participation. Ethical considerations were carefully observed throughout the research process to protect participants' privacy and confidentiality. Participants were also informed that they could withdraw from the study at any stage without any consequences. To maintain anonymity, the identities of participants and organizations were replaced with pseudonyms such as "Company 1" and "Company 2." These ethical procedures align with qualitative research standards recommended by Lincoln and Guba (1985) to ensure trustworthiness and research integrity.

Data Analysis

The collected data were analyzed using thematic analysis based on Braun and Clarke's (2006) six-phase thematic analysis approach. Thematic analysis was selected because it is a flexible and widely used qualitative data analysis method that enables researchers to identify, analyze, and interpret recurring themes and patterns within qualitative data. According to Braun and Clarke (2006), thematic analysis is particularly suitable for exploratory studies because it allows researchers to systematically organize and interpret participants' experiences and perspectives. The approach is also appropriate for studies grounded in interpretivist philosophy, as it facilitates deeper understanding of social meanings and interactions.

The analysis process involved six systematic phases: familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report (Braun & Clarke, 2006). In the first phase, all interview recordings were transcribed verbatim to ensure accuracy and completeness of the data. The researcher repeatedly reviewed the interview transcripts to become familiar with the content and identify preliminary ideas and recurring concepts related to Quintuple Helix collaboration. According to Nowell et al. (2017), repeated engagement with qualitative data enhances analytical rigor and improves researchers' understanding of participants' experiences.

In the second phase, relevant statements and responses were systematically coded according to recurring concepts identified within the transcripts. Coding was conducted manually by categorizing meaningful segments of data related to collaboration, organizational sustainability, stakeholder involvement, and community development. The coding process enabled the researcher to organize the data into meaningful categories and identify relationships among participants' responses.

Subsequently, the codes were grouped into broader themes representing the five helices within the Quintuple Helix framework, namely university support, industry collaboration, government support, public society

involvement, and environmental sustainability. These themes were then reviewed and refined to ensure consistency, coherence, and alignment with the research objectives. According to Braun and Clarke (2006), reviewing and refining themes is essential to ensure that the themes accurately represent the data and contribute meaningfully to the overall analysis.

Finally, the identified themes were interpreted and presented in the findings section together with supporting quotations from participants. The use of direct quotations enhanced the credibility and trustworthiness of the findings by illustrating participants' actual experiences and perspectives. This thematic analysis process enabled the researcher to generate comprehensive insights into how Quintuple Helix collaboration supports social enterprises in Malaysia. To enhance analytical rigor, coding decisions, theme development processes, and interpretive reflections were documented throughout the analysis process, creating a transparent audit trail (Nowell et al., 2017). Table 2 are the example of coding development.

Table 2: Example of coding development

Raw Data	Initial Code	Category	Theme
"Universities provide us with interns and research support."	Internship support	Knowledge transfer	University Support
"Government grants help sustain our community projects."	Financial assistance	Institutional support	Government Support
"Corporate partners provide mentoring and networking opportunities."	Business mentorship	Industry engagement	Industry Collaboration

Trustworthiness and Ethical Considerations

To ensure the trustworthiness of the study, several strategies were implemented, including credibility, transferability, dependability, and confirmability, as recommended by Lincoln and Guba (1985). Trustworthiness is an essential component in qualitative research as it ensures the accuracy, consistency, and reliability of the findings (Nowell et al., 2017). Credibility was enhanced through prolonged engagement with the data, repeated review of interview transcripts, and careful interpretation of participants' responses to ensure that the findings accurately reflected participants' experiences and perspectives. According to Creswell and Creswell (2017), credibility in qualitative research can be strengthened through detailed data examination and continuous interaction with the research material.

Dependability was achieved by maintaining a clear audit trail throughout the research process, including documentation of data collection procedures, interview protocols, coding processes, and thematic analysis decisions. This process allows other researchers to understand how the findings were generated and enhances the consistency of the research process (Lincoln & Guba, 1985). Confirmability was further supported by ensuring that the findings were grounded in participants' responses rather than researcher bias or personal assumptions. Direct quotations from participants were included in the findings section to provide transparency and support the interpretation of the data.

Transferability was addressed by providing detailed descriptions of the research context, participants, and data collection procedures. Such detailed explanations enable readers to assess the applicability of the findings to similar contexts or settings (Polit & Beck, 2010). Furthermore, ethical considerations were carefully observed throughout the study to protect participants' rights and confidentiality.

Participants' confidentiality and anonymity were strictly protected throughout the research process. The names of organizations and participants were replaced with pseudonyms such as "Company 1" and "Company 2" to maintain privacy and prevent identification. Participation in the study was entirely voluntary, and participants were informed about the objectives of the study, confidentiality procedures, and their right to withdraw from the research at any stage without consequences. Informed consent was obtained from all participants prior to the interviews, ensuring adherence to ethical research standards and principles (Saunders et al., 2019).

FINDINGS

University Support

The findings revealed that universities play a significant role in supporting social enterprises through training programs, internships, research collaboration, volunteering activities, and knowledge-sharing initiatives. Participants consistently described universities as valuable partners that contribute to organizational learning, innovation capability, and human capital development. Within the Quintuple Helix framework, universities serve as knowledge producers and facilitators of innovation, providing intellectual resources that help social enterprises address social and environmental challenges (Carayannis et al., 2012).

Several participants explained that universities frequently organize entrepreneurship workshops, mentoring sessions, and innovation programs that help improve organizational competencies and sustainability. One participant stated:

“We collaborate with universities through internship and training programs.” (Company 2)

Another respondent explained:

“Universities provide us with exposure and research support that help improve our organizational development.” (Company 5)

Beyond the immediate benefits of training and internships, the findings suggest that universities function as knowledge intermediaries that bridge academic expertise and practical social innovation. Participants indicated that collaborations with universities exposed them to new ideas, research findings, and problem-solving approaches that enhanced their organizational capacity. This observation supports Guerrero et al. (2016), who argued that entrepreneurial universities contribute to regional innovation by facilitating knowledge transfer and collaborative learning.

A particularly important insight emerging from the data is that universities often act as connectors within the broader collaborative ecosystem. Several participants indicated that university partnerships facilitated access to industry networks, government programs, and community initiatives. This finding aligns with the Triple and Quintuple Helix literature, which views universities as boundary-spanning institutions that facilitate interaction among multiple societal factors (Etzkowitz & Zhou, 2023). Therefore, university contributions should not be viewed solely in terms of education and research but also as mechanisms for ecosystem integration.

The findings suggest that internship programs are particularly beneficial because they allow students to contribute knowledge, technical skills, and innovative ideas while simultaneously gaining practical experience in social entrepreneurship activities. This finding aligns with Sidek et al. (2018), who found that entrepreneurial universities in Malaysia contribute toward social entrepreneurship development through practical training and experiential learning initiatives.

In addition, universities contribute through research collaboration and knowledge-sharing activities. Several respondents emphasized that collaborations with academic institutions provide access to expertise, innovation resources, and professional networks that strengthen organizational sustainability. One respondent mentioned:

“We receive support from universities in terms of research and innovation ideas that help improve our services.” (Company 8)

This supports findings by Yusuf and Nabeshima (2007), who explained that university-industry-community collaboration strengthens innovation capability and organizational sustainability through research commercialization and knowledge exchange.

However, despite these benefits, some participants highlighted that university collaboration remains limited and inconsistent. Several respondents noted that stronger and long-term partnerships between universities and social enterprises are still needed to improve sustainability and community impact. Overall, the findings demonstrate

that university collaboration contributes positively toward knowledge transfer, organizational development, and innovation within Malaysian social enterprises.

Industry Collaboration

Industry collaboration emerged as another important factor supporting social enterprises in Malaysia. Participants explained that partnerships with industries and private organizations provide mentorship, networking opportunities, funding support, technological expertise, and market access. Such collaborations help social enterprises strengthen their operational capabilities and improve long-term sustainability.

Many respondents highlighted that industry mentorship contributes significantly toward business development and organizational growth. One participant stated:

“Industry networking and mentorship help us improve our business operations and strategic planning.”
(Company 6)

This finding supports Urbano et al. (2017), who argued that collaborative business ecosystems encourage innovation, adaptability, and sustainability among entrepreneurial organizations. Similarly, Etzkowitz and Zhou (2023), emphasized that industry collaboration strengthens innovation systems by providing practical expertise and market-oriented knowledge.

Participants also explained that private organizations frequently support social enterprises through capacity-building programs, sponsorships, and collaborative projects. These partnerships allow social enterprises to gain exposure to professional expertise and industry knowledge that may otherwise be inaccessible due to limited resources. One respondent explained:

“Corporate organizations provide opportunities for us to expand our programs through sponsorship and collaborative initiatives.” (Company 3)

The findings further demonstrate that industry collaboration often occurs in conjunction with government and university initiatives. Several participants reported being introduced to corporate partners through entrepreneurship programs organized by government agencies or universities. This suggests that industry contributions are embedded within wider ecosystem relationships rather than functioning independently. Such interdependence supports Quintuple Helix theory, which emphasizes collaborative value creation across multiple societal actors (Carayannis et al., 2018).

Government Support

Government support was identified as one of the most significant factors influencing the sustainability and growth of social enterprises in Malaysia. Participants emphasized that government agencies provide various forms of support, including grants, entrepreneurship training, policy initiatives, networking opportunities, and licensing assistance. Within the Quintuple Helix framework, governments function as facilitators that establish supportive ecosystems for innovation, entrepreneurship, and sustainable development (Carayannis et al., 2012).

One participant explained:

“Government support and financial assistance are very important for our sustainability and growth.” (Company 8)

Another respondent stated:

“Government grants help us continue our community programs and improve our services.”

(Company 1)

While financial assistance was frequently cited as a crucial form of support, the findings suggest that government contributions extend far beyond funding provision. Participants emphasized that government recognition

enhances organizational legitimacy, credibility, and stakeholder confidence. These findings are consistent with Rahdari et al. (2016), who argued that access to funding and grants significantly influences the sustainability of social enterprises because many organizations struggle to balance financial stability with social objectives. Similarly, Defourny and Nyssens (2010), emphasized that institutional financial support enables social enterprises to maintain long-term social missions and organizational continuity.

Participants also discussed the role of government entrepreneurship programs and training workshops in improving organizational capabilities. Government agencies such as MaGIC and MEDAC were frequently mentioned as important contributors to the Malaysian social enterprise ecosystem. According to respondents, these agencies provide mentorship, startup support, networking programs, and entrepreneurship development initiatives that strengthen organizational sustainability.

One respondent explained:

“The training and networking provided by government agencies help us improve our business operations and connect with other stakeholders.” (Company 6)

This finding aligns with Adnan et al. (2018), who found that government entrepreneurship programs contribute significantly toward strengthening social enterprise capabilities and community empowerment initiatives in Malaysia.

In addition, participants highlighted the significance of policy initiatives such as the Social Enterprise Blueprint and Social Enterprise Accreditation (SE.A) in increasing institutional recognition and legitimacy for social enterprises. One respondent explained:

“The accreditation and government recognition help build trust with stakeholders and partners.” (Company 10)

This finding supports Nicholls (2010), who argued that institutional support enhances the legitimacy and visibility of social enterprises, enabling them to attract partnerships, funding opportunities, and public trust.

The findings also revealed that government collaboration facilitates networking opportunities between social enterprises and external stakeholders, including investors, industries, and universities. Such collaborations help organizations expand partnerships and improve resource accessibility.

However, despite the positive contributions, participants also identified several challenges associated with government support. Common issues included bureaucratic procedures, limited access to funding, and complex application processes for grants and support programs. Some respondents expressed the need for more consistent policy implementation and long-term support mechanisms for social enterprises. This finding is supported by Saebi et al. (2019), who noted that limited institutional coordination and policy-related barriers remain challenges for Malaysian social enterprises.

Public Society Support

Public society support emerged as another important theme within the findings. Participants explained that local communities, volunteers, consumers, and civil society organizations contribute significantly toward the sustainability and social impact of social enterprises. Public participation strengthens organizational legitimacy, community engagement, and stakeholder relationships. Within the Quintuple Helix framework, public society functions as an important subsystem that facilitates communication, participation, and social innovation (Carayannis et al., 2012).

One participant stated:

“Public volunteering and community engagement help us achieve our social mission.” (Company 10)

Another explained:

“Community feedback helps us improve our programs and understand what the beneficiaries really need.” (Company 4)

The findings suggest that public society contributes more than volunteer labor and financial support. Participants consistently emphasized the importance of community feedback in shaping program design and service delivery. This finding supports Matarrita-Cascante and Brennan (2012), who argued that community participation enhances empowerment, social cohesion, and sustainable development outcomes.

From a theoretical perspective, public society functions as a source of contextual knowledge and social legitimacy. Communities provide insights into local needs and challenges, enabling social enterprises to develop more relevant and effective interventions. This finding is consistent with Doherty et al. (2014), who explained that collaborative relationships with communities strengthen stakeholder relationships and improve social impact among social enterprises.

In addition, participants emphasized that public awareness campaigns and social media engagement contribute toward increasing visibility and community support for social enterprises. Some respondents noted that community trust and public participation are essential for achieving long-term sustainability and social impact. According to Saebi et al. (2019), active stakeholder engagement improves organizational adaptability, legitimacy, and sustainability among social enterprises.

Moreover, strong interactions were observed between public society and other helices. Community participation frequently enhanced the effectiveness of government initiatives, environmental programs, and university outreach activities. This finding supports the Quintuple Helix proposition that innovation and sustainability emerge through collaborative interactions among societal actors rather than isolated stakeholder contributions (Carayannis et al., 2012).

Environmental Support

Environmental sustainability was identified as an important component of Quintuple Helix collaboration among social enterprises in Malaysia. Participants explained that environmental organizations, sustainability initiatives, and green practices contribute significantly toward organizational sustainability and community development. Within the Quintuple Helix framework, the natural environment acts both as a resource provider and a driver of sustainable innovation (Carayannis & Campbell, 2014).

Several respondents highlighted their involvement in environmentally responsible initiatives such as recycling programs, sustainable agriculture, eco-tourism, and environmental education activities. One participant explained:

“We focus on environmental sustainability and green initiatives within our projects.” (Company 7)

Another respondent stated:

“Our organization promotes recycling and environmental awareness programs within the community.” (Company 9)

Unlike the other helices, environmental sustainability was not perceived as a standalone stakeholder but rather as an overarching objective influencing organizational decisions and collaborative activities. Participants frequently linked environmental initiatives to broader social and economic goals, reflecting the interconnected nature of sustainable development.

These findings are consistent with Rahdari et al. (2016), who explained that social enterprises increasingly integrate environmental objectives into their business models to create long-term societal value. Similarly, Elkington (1997) emphasized that sustainable organizations must balance economic, social, and environmental objectives through the Triple Bottom Line approach.

Furthermore, environmental projects often required support from universities, government agencies, industries, and communities. Consequently, environmental sustainability appears to function as a catalyst for inter-helix collaboration. Similar observations were reported by Mensah (2019), who argued that environmental sustainability is closely linked to social and economic sustainability because environmental degradation directly affects community well-being and future development.

In addition, some respondents explained that environmental organizations provide guidance and support for implementing green initiatives and sustainable business practices. These collaborations help social enterprises align their operations with Sustainable Development Goals (SDGs) and environmental sustainability objectives.

Participants also emphasized the growing importance of environmental awareness among communities and stakeholders. Several organizations actively conduct environmental education programs to encourage responsible behavior and sustainable lifestyles among beneficiaries and local communities. According to Amran et al. (2012), sustainability initiatives and environmental awareness programs contribute significantly toward improving environmental responsibility among Malaysian organizations and communities.

DISCUSSION

The findings of this study demonstrate that the sustainability and effectiveness of social enterprises in Malaysia are shaped by the collective contributions of universities, industries, government agencies, public society, and environmental actors. While previous studies have emphasized the individual roles of these stakeholders in supporting innovation and sustainable development (Carayannis et al., 2012; Carayannis et al., 2018), the present findings suggest that social enterprise sustainability emerges through the dynamic interactions among the five helices rather than through isolated stakeholder contributions. Universities were found to contribute not only through training, internships, and research support but also by acting as knowledge intermediaries that facilitate innovation and organizational learning. This finding supports the entrepreneurial university perspective proposed by (Etzkowitz & Zhou, 2023), which positions universities as active participants in societal development rather than merely providers of education. Importantly, university collaborations often created opportunities for social enterprises to connect with industry partners and government initiatives, highlighting their role as ecosystem connectors within the broader collaborative network.

The findings further reveal that industry collaboration contributes to social enterprise sustainability beyond the provision of financial support. Participants emphasized the importance of mentorship, professional guidance, networking opportunities, and access to markets, which enhanced their organizational capabilities and strategic development. This finding aligns with the concept of Creating Shared Value (Kramer & Porter, 2011), which suggests that collaboration between businesses and social organizations can generate both economic and social benefits. However, the findings indicate that industry support rarely operates independently. Instead, industry engagement was frequently facilitated through government-sponsored entrepreneurship programs and university networks. This suggests that effective collaboration within the Quintuple Helix ecosystem depends on the interconnectedness of stakeholders and their ability to mobilize complementary resources. Consistent with Galvao et al. (2021), innovation and sustainability are therefore better understood as outcomes of collaborative ecosystems rather than the actions of individual factors.

Government support emerged as one of the most influential factors affecting the sustainability of social enterprises. While participants acknowledged the importance of grants, training programs, and policy initiatives, the findings suggest that government support extends beyond financial assistance. Government recognition through initiatives such as the Social Enterprise Accreditation (SE.A) scheme was perceived as a source of legitimacy that strengthened stakeholder trust and improved access to partnerships and funding opportunities. This finding supports Nicholls (2010), who argued that legitimacy is a critical resource for social enterprises operating within complex institutional environments. Furthermore, the findings indicate that government agencies perform a coordinating role by facilitating interactions among universities, industries, and social enterprises. Such a role is consistent with the Quintuple Helix framework, which positions governments as facilitators of collaborative innovation and sustainable development (Carayannis et al., 2018). Nevertheless, participants also highlighted bureaucratic barriers and funding constraints, suggesting that stronger policy

coordination and more accessible support mechanisms are necessary to maximize the effectiveness of government interventions.

Another important finding concerns the role of public society in supporting social enterprises. Community participation was found to extend beyond volunteering and public support, contributing directly to organizational learning, program improvement, and social legitimacy. Participants reported that feedback from beneficiaries and local communities helped social enterprises better understand societal needs and design more responsive interventions. This finding supports Matarrita-Cascante and Brennan (2012), who emphasized the role of community engagement in fostering empowerment and sustainable development. It also aligns with Doherty et al. (2014), who highlighted the importance of stakeholder engagement in strengthening social enterprise impact. The findings therefore suggest that public society functions not only as a beneficiary of social enterprise activities but also as a co-creator of social value. Moreover, community engagement was found to reinforce the effectiveness of other helices by supporting university outreach activities, participating in government initiatives, and contributing to environmental sustainability programs.

Environmental sustainability emerged as a distinctive feature of the findings and reflects the unique contribution of the Quintuple Helix framework. Participants described environmental initiatives such as recycling programs, sustainable agriculture, eco-tourism, and environmental education as integral components of their organizational missions. Unlike the other helices, environmental sustainability was not perceived as a separate stakeholder but rather as a shared objective that guided collaborative activities across the ecosystem. This finding supports Carayannis et al. (2012), who argued that environmental considerations should be embedded within innovation systems to achieve sustainable development. The findings further reinforce (Elkington, 1997) Triple Bottom Line framework by demonstrating how social enterprises simultaneously pursue economic, social, and environmental objectives. Importantly, environmental initiatives frequently required collaboration among universities, industries, governments, and local communities, suggesting that environmental sustainability serves as a catalyst for inter-helix cooperation and collective action.

Overall, the findings extend the Quintuple Helix literature by demonstrating that social enterprises function as ecosystem orchestrators that actively coordinate relationships among multiple stakeholders to generate sustainable community outcomes. Rather than acting as passive recipients of support, social enterprises integrate knowledge, resources, legitimacy, and community participation derived from different helices to address complex societal challenges. This study therefore contributes theoretically by proposing that the effectiveness of the Quintuple Helix framework depends not only on the presence of the five helices but also on the quality of interactions among them. Based on the findings, a conceptual understanding emerges in which social enterprises occupy a central position within the collaborative ecosystem, facilitating knowledge exchange, resource mobilization, stakeholder engagement, and sustainability-oriented innovation. This perspective advances existing Quintuple Helix theory by highlighting the central coordinating role of social enterprises in achieving sustainable community development within emerging economies such as Malaysia.

CONCLUSION

This study explored the role of Quintuple Helix collaboration in supporting social enterprises and promoting sustainable community development in Malaysia. The findings demonstrate that the sustainability and effectiveness of social enterprises are shaped not by the contributions of individual stakeholders alone, but by the dynamic interactions among universities, industries, government agencies, public society, and environmental actors. These collaborative relationships enable social enterprises to access knowledge, financial resources, institutional legitimacy, community participation, and sustainability-oriented practices that collectively strengthen their innovation capability and social impact.

Beyond identifying the individual contributions of each helix, the study highlights the importance of inter-helix synergies in fostering sustainable social entrepreneurship. The findings reveal that universities act as knowledge intermediaries, industries provide strategic resources and market access, governments facilitate institutional legitimacy and ecosystem coordination, public society contributes social support and local knowledge, while environmental considerations serve as an integrating force that guides collective action toward sustainable

development. Consequently, social enterprise sustainability emerges from the interconnectedness of the five helices rather than from isolated stakeholder contributions.

The study contributes theoretically by extending the application of the Quintuple Helix framework to the context of social entrepreneurship in Malaysia, which remains relatively underexplored in existing literature. More importantly, the findings suggest that social enterprises function as ecosystem orchestrators that actively coordinate relationships among multiple stakeholders and translate collective resources into sustainable community outcomes. This perspective advances Quintuple Helix theory by shifting attention from the individual roles of stakeholders toward the interactions and complementarities among helices. Based on the empirical findings, a conceptual understanding emerges in which social enterprises occupy a central position within the collaborative ecosystem, facilitating knowledge exchange, resource mobilization, stakeholder engagement, and sustainability-oriented innovation.

From a practical perspective, the findings provide important implications for policymakers, universities, industries, and community organizations. Policymakers should strengthen institutional support mechanisms, improve policy coordination, and simplify funding procedures to enhance the sustainability of social enterprises. Universities and industries should establish more strategic and long-term partnerships that promote knowledge transfer, innovation, and entrepreneurial capability development. At the same time, greater public awareness and stronger community engagement initiatives are needed to increase societal participation and support for social enterprises. Furthermore, environmental sustainability should be embedded within collaborative initiatives to ensure that economic and social development objectives are pursued alongside ecological preservation.

Despite its contributions, this study has several limitations. First, the research adopted a qualitative approach involving eleven social enterprises, which limits the transferability of the findings to other contexts. Second, the study focused exclusively on Malaysian social enterprises and therefore may not fully capture the diversity of collaborative ecosystems in different institutional and cultural settings. Future studies are encouraged to employ quantitative or mixed-method approaches with larger samples to examine the relationship between Quintuple Helix collaboration and social enterprise performance. Comparative studies across countries and sectors would provide further insights into how institutional environments influence collaborative mechanisms and sustainability outcomes. In addition, future research could investigate the dynamic interactions among helices and empirically validate the conceptual framework proposed in this study.

In conclusion, the study demonstrates that Quintuple Helix collaboration constitutes a critical ecosystem for strengthening social enterprises and advancing sustainable community development in Malaysia. The findings underscore that sustainable social innovation depends on collaborative relationships that integrate knowledge, resources, legitimacy, and environmental responsibility across multiple stakeholders. As complex societal and environmental challenges continue to intensify, stronger inter-helix collaboration will become increasingly important in enabling social enterprises to generate lasting social, economic, and ecological value.

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Ethical Approval

Ethical approval for this study was obtained from the relevant institutional ethics committee prior to data collection. All participants were informed about the purpose of the study, confidentiality procedures, and their right to withdraw from the study at any stage without consequences. Informed consent was obtained from all participants before conducting the interviews, and participants' identities were kept anonymous using pseudonyms such as "Company 1" and "Company 2."

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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